Operation SOLAR

Protecting Solar Access:

Tips for Builders and Homeowners

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Introduction

In 1981, Northeast Utilities (NU) introduced an energy conservation plan which became known as NU 80s/90s. The overall goals of the plan are to reduce NU's use of oil for generation and to hold the growth rate in electric use to 1.5 percent per year or less.

The use of alternatives to conventional energy forms is an important part of NU 80s/90s.

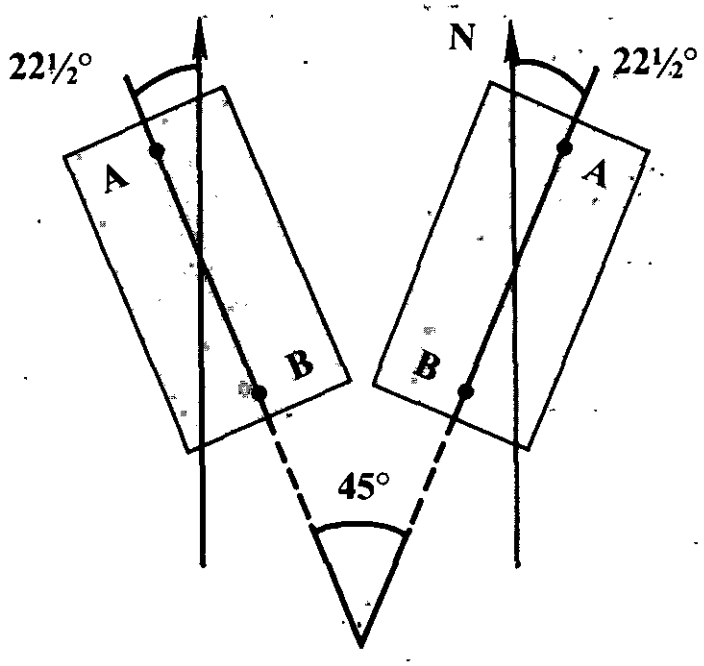
Operation SOLAR is the program which seeks to promote the use of both active and passive solar energy by identifying feasible and economic applications. Energy Management Services (EMS) energy consultants offer technical assistance and information to those NU customers and builders/developers who are considering the solar alternative.

Access to solar energy is essential to the operation of solar energy systems. It is as indispensible as a fuel nozzle to an oil burner. Without it there is no energy.

Despite its importance, many homeowners and contractors have paid precious little attention to the proper siting and orientation of solar collectors. In 1979, the University of Connecticut inspected 153 solar domestic hot water heaters funded by United States Department of Housing and Urban Development and found that as many as 27 percent of all the collectors were shaded or about to be shaded by buildings or vegetation. In some cases, shadows originated from vegetation or buildings on the owner's property; in other cases, the cause of the shadow originated on a neighbor's property.

Homeowners, builders and solar contractors can avoid many solar access problems by considering some of the following remedies:

Figure 1



1. Select a Building Lot Elongated Along the North-South Axis

If you are building a solar home, you should locate a lot which is elongated along the north-south axis since that ensures the maximum separation between your proposed house location and that of your neighbors to the south (see Figure 1).

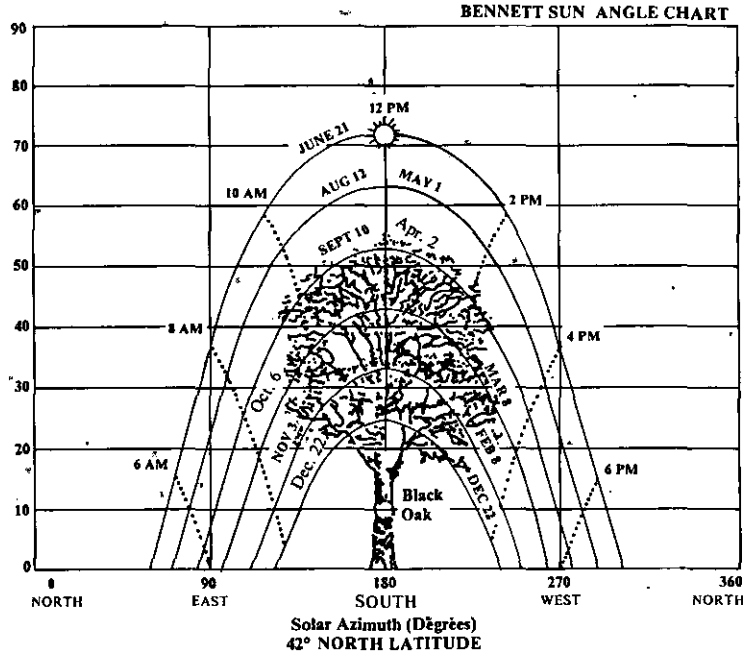
Table 1

Formula for determining Minimum Setback of a Ground Mounted Solar Collector from a Neighbor's Building Built at the Minimum Setback Allowed by Zoning Regulations		
Minimum Setback from Property Line	=	Maximum Building Height Allowed by Zoning / Tangent of Sun's Altitude Angle: December 21
	−	Required Setback
NOTE: This formula assumes flat land between the collector and the neighboring buildings		

2. Maximize the Distance Between the Solar Collector and Neighboring Property

Your neighbor has the right to develop his property within the setback constraints of local zoning regulations. If you place a solar collector too close to a property line, there may be insufficient distance between your solar collector and any building your neighbor might build in the future. Minimum setbacks and maximum building heights can be determined by consulting the zoning regulations of the community. With this information, a homeowner can determine the maximum shadow length that might be cast by the tallest building allowed by the zoning regulations. The formula in Table 1 provides a simple technique for determining minimum setback needed for solar access protection

Figure 3



3. Evaluate Solar Access Based on the Sun's Position on December 21

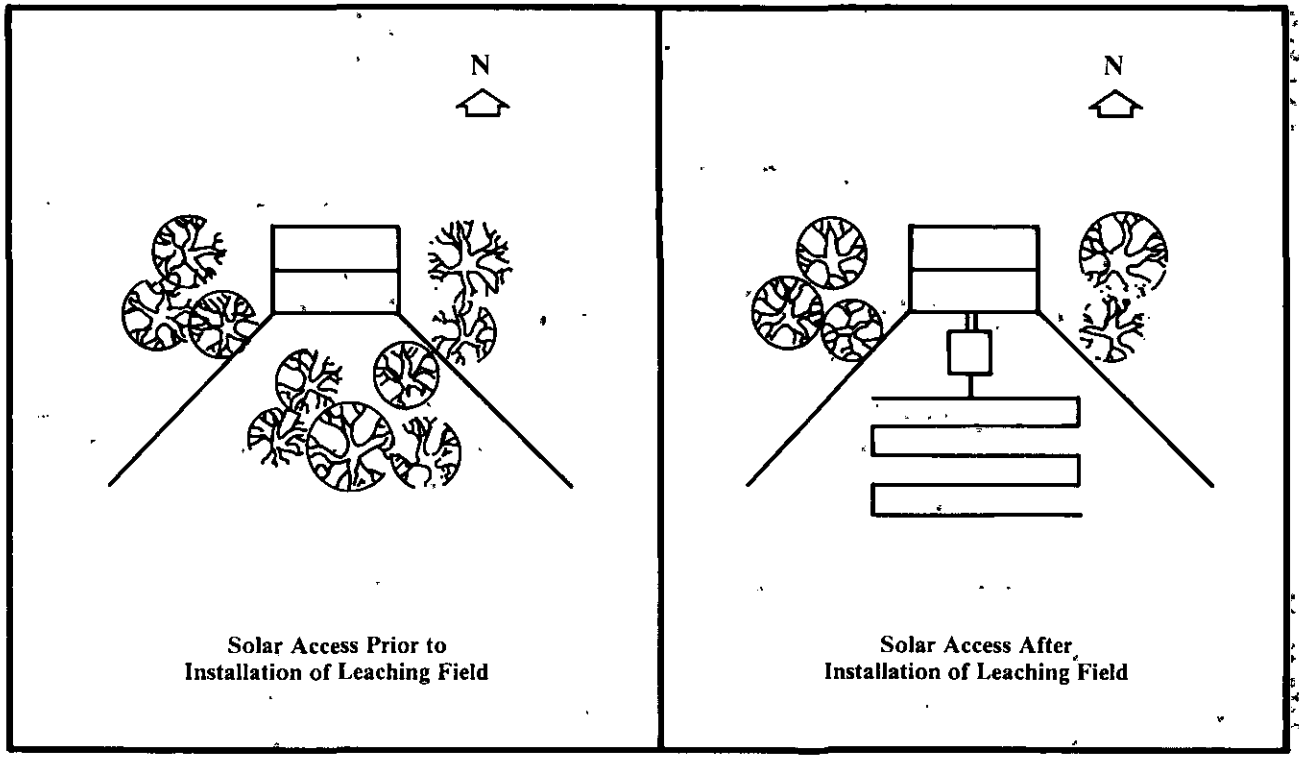
The sun's path through the sky on December 21 established the lower limits of the solar window. Any object which protrudes through the solar window must be removed or pruned in order to ensure full solar access (see Figure 3). It is not necessary to wait till December 21 in order to determine the level of solar access available to your solar collector.

There are a variety of tools that can accomplish this evaluation at any time of year. The tools range from sophisticated laser transits to simple hand-held sun charts. For most purposes, a sun chart or rule-of-thumb estimates may be satisfactory for determining the most likely times and locations where shading will occur.

4. Protect Solar Access from 9:00 a.m. to 3:00 p.m.

Municipalities in Connecticut are authorized to offer property tax exemptions to passive solar energy systems that have access to sunlight for 75 percent of the time between 9:00 a.m. and 3:00 p.m. local time on December 21. Check with your town assessor or town clerk to see if your community has adopted the passive solar property tax exemptions. In Massachusetts, property tax exemption legislation does not stipulate a minimum level of solar access protection.

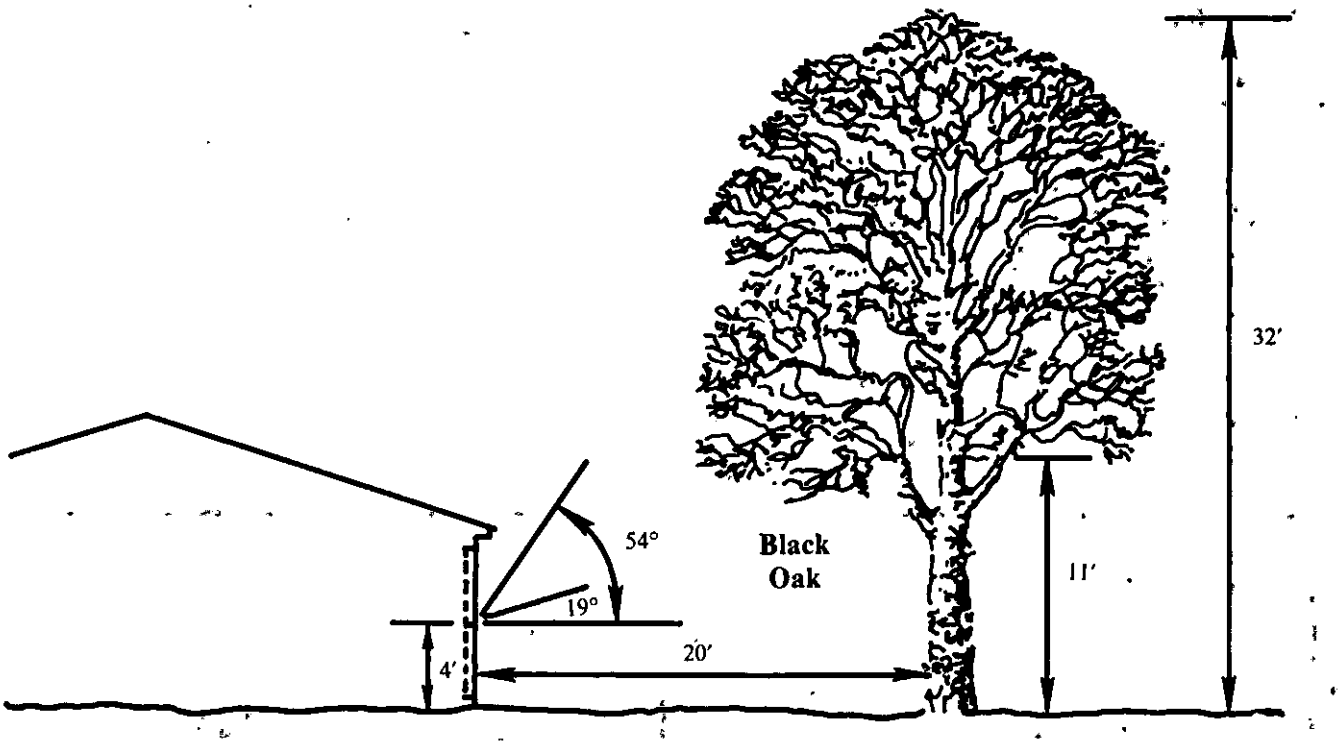
Figure 4



5. Locate the Septic System Drainage Field on the South Side of the House

When a septic system drainage field is installed, all vegetation that might interfere with the proper function of the drain fields must be removed. Drainage fields located within the solar access zone of the house help to eliminate unwanted shadow-casting trees and shrubs (see Figure 4).

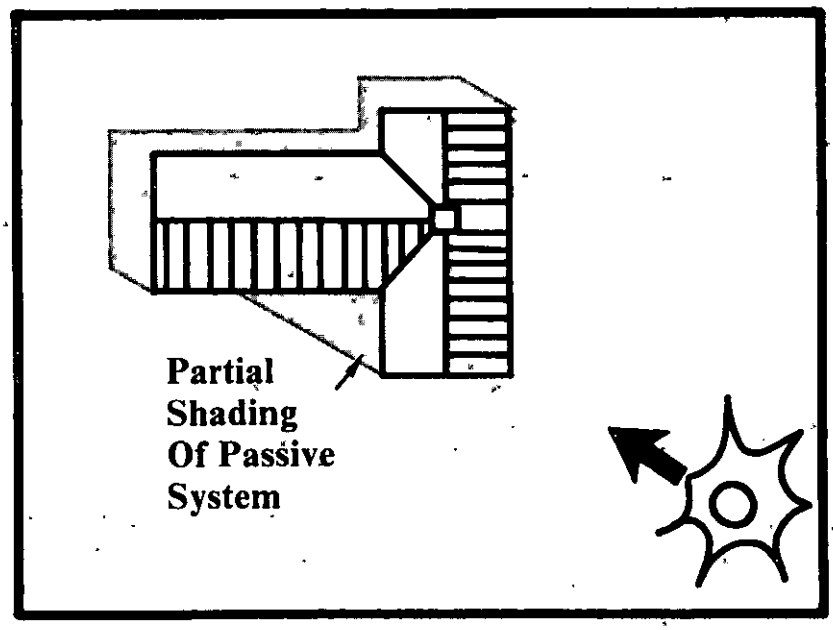
Figure 5



6. Avoid Planting Trees within the Solar Zone

Oftentimes the biggest obstacles to unobstructed solar access are self created: homeowners planting inappropriate tree species on the south side of the home (see Figure 5).

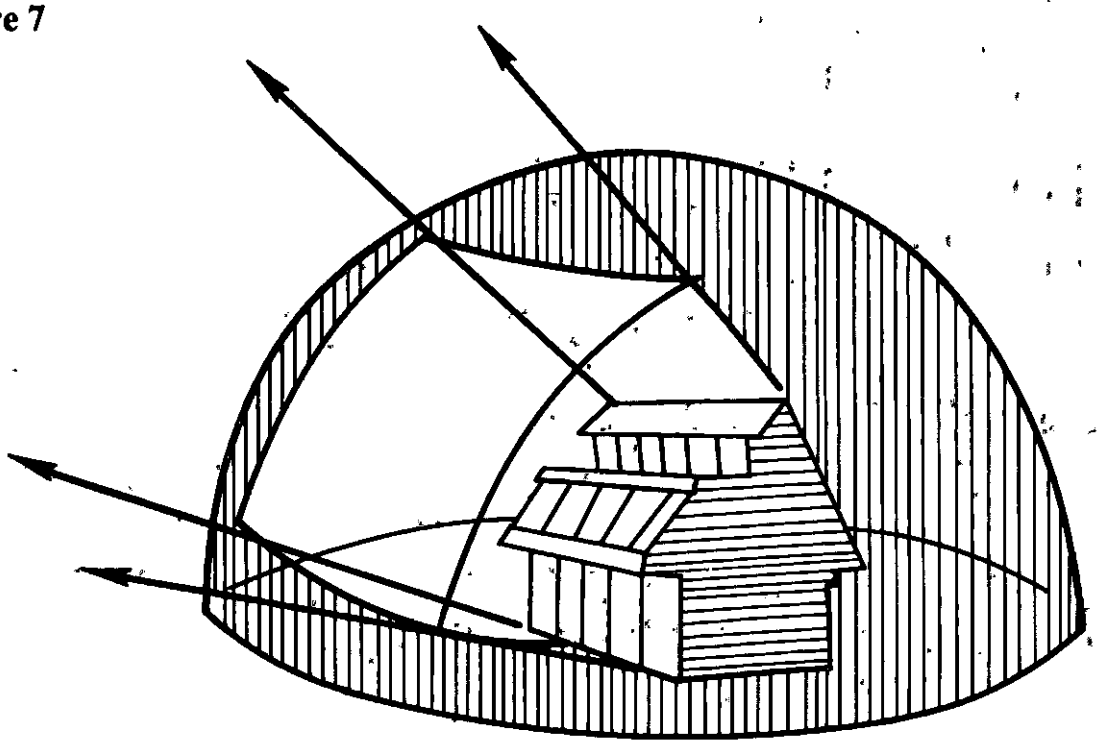
Figure 6



7. Avoid Building Designs that Create Self Shading

Lack of understanding of sun angles is responsible for common design error. One part of the building shades itself during certain hours of the day. The most common self-shading problems are associated with shadows cast by chimneys, dormer roofs and excessive roof overhangs on the south side of the house (see Figure 6). Roof overhangs should be designed using the formula in Table 2.

Figure 7

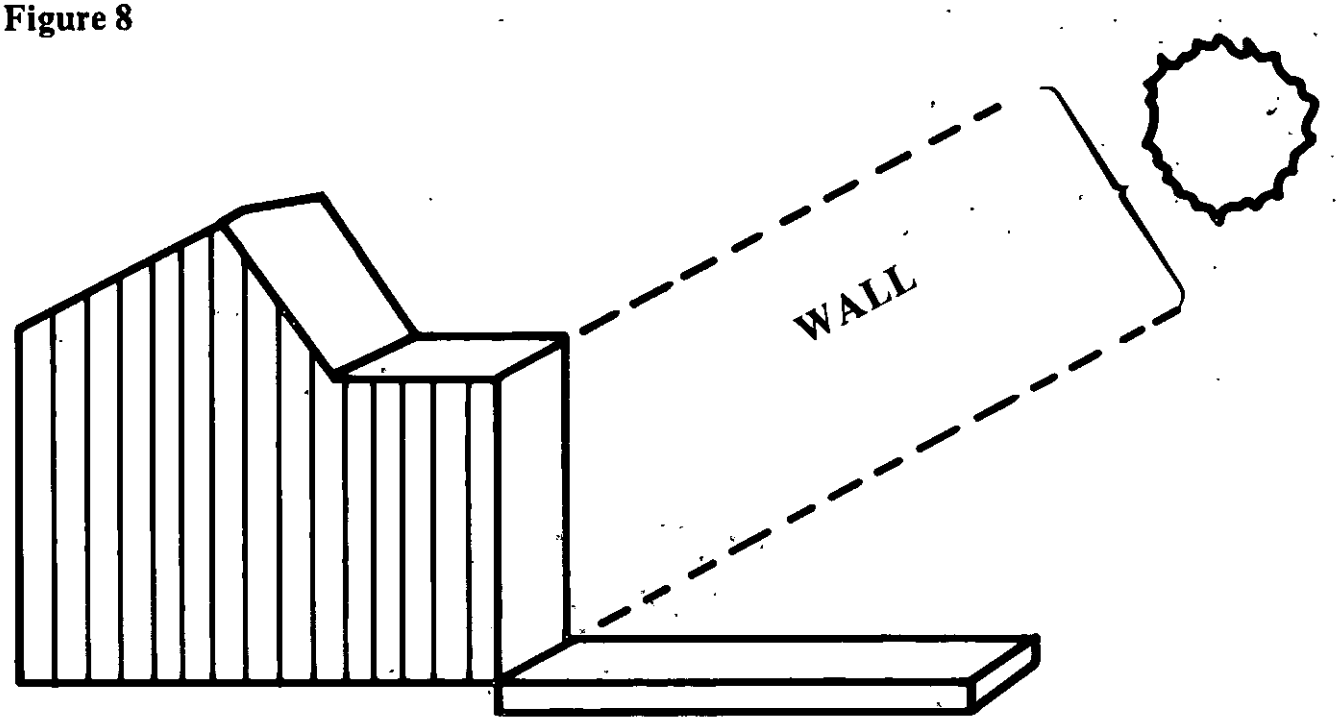


Skyview: That portion of the unobstructed sky the collector must see to operate effectively.

8. Purchase an Easement for Unobstructed Solar Access from Your Neighbor

Where vegetation or construction on a neighbor's property might shade your solar energy system, try to purchase a solar easement at the earliest possible date. If the solar easement does not adversely affect your neighbor's development rights, it may be relatively easy to purchase. Model solar easements are available but an attorney should be consulted to make sure the easement used is consistent with state law (see Figure 7).

Figure 8



South Wall Solar Access Standard: Thomaston, CT

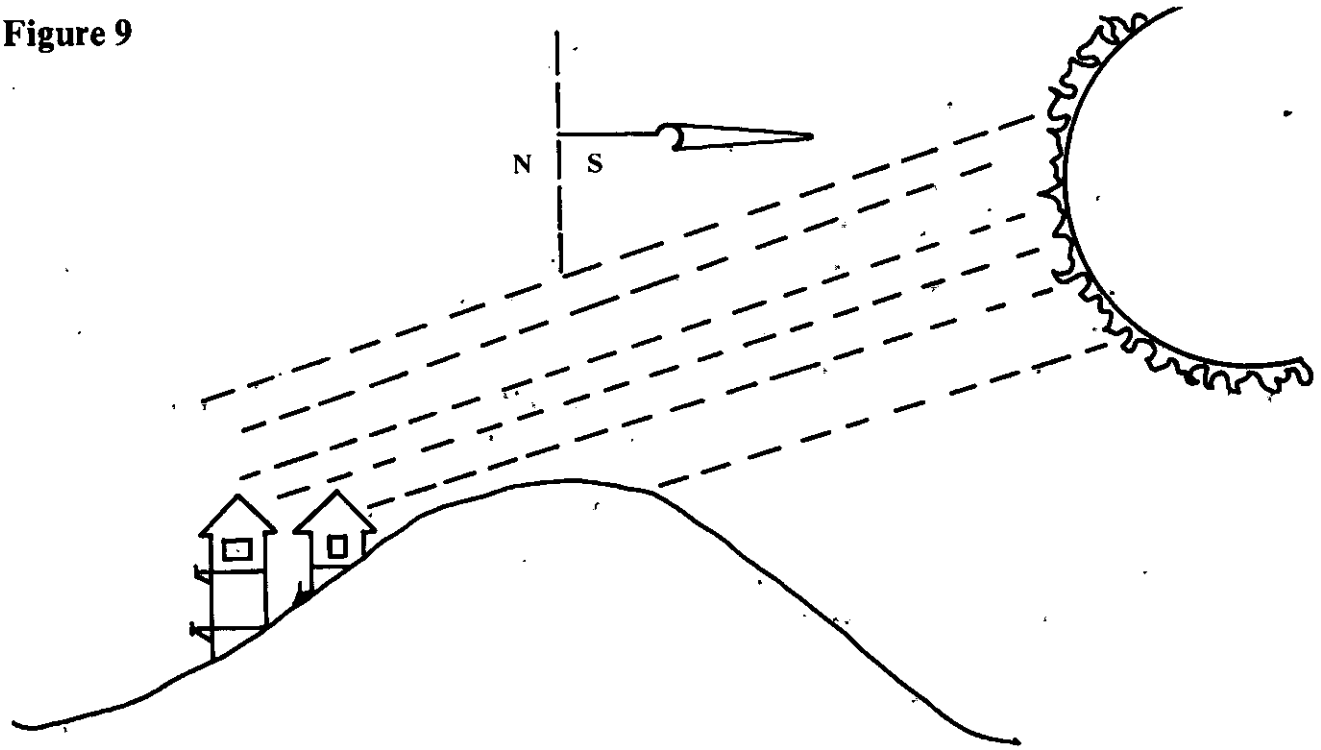
9. Encourage Your Community to Adopt a Solar Access Protection Ordinance

Several communities in Connecticut have already adopted solar access protection standards within their zoning regulations in order to guarantee the continuous usability of solar energy for all residents. Connecticut's land-use law enables a zoning commission to establish a solar access ordinance in order to encourage the long-term development of solar energy. While the state of Massachusetts has not enacted any solar access legislation, local zoning boards could protect solar access by the powers already granted to municipalities through state-enabling legislation. The principal advantage of a communitywide solar access protection ordinance is that expensive investments in solar energy systems can be made with the assurance of their long-term protection (see Figure 8).

10. Make Your Neighbor Aware of Your Solar Energy System

Many solar access problems may be solved simply by having a better relationship with your neighbor. If your neighbor is aware of the fact that you are adding a solar greenhouse onto your home, he may become more attentive to the type of trees and shrubs he plants nearby.

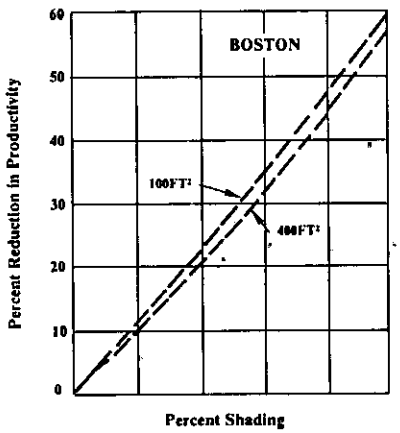
Figure 9



11. As a Last Resort, Seek an Attorney Familiar with Nuisance Law

If your solar home is shaded by the construction activities of a neighbor, you may be able to seek relief in a court of law. In 1982, the Wisconsin Supreme Court issued a landmark decision which granted a right to light under nuisance law. While neither the Connecticut or Massachusetts Supreme Courts have yet heard a similar solar access case, the Wisconsin Supreme Court decision establishes a legal precedent for the right to light which may be favorably viewed by the Connecticut or Massachusetts Supreme Courts.

Figure 10



12. Determine the Energy Impact of Shadow-Casting Objects

It may not always be possible to remove all objects casting shadows on the solar collector. For example, natural obstructions created by distant mountains must be considered as one of the natural constraints of the site (see Figure 9). Where shading is inevitable, efforts should be made to compensate for the reduced level of solar energy by expanding the solar collection area or minimizing the heat-load requirements of the home.

If your solar home is shaded for 10 percent of the time you can assume that there is about a 10 percent reduction in its energy productivity. As the level of shading increases, the amount of solar energy lost also increases (see Figure 10). Shading becomes a severe problem whenever a dwelling unit relies on solar energy as its primary form of energy. A homeowner with a 100 percent solar-heated home cannot afford to sacrifice his solar access whereas the owner of a conventional dwelling unit may pay little attention to objects obstructing sunlight to his home, due to the fact that he does not realize the dollar value of his solar access.

Table 2

Formula for Determining Proper Roof Overhang

$$\text{Horizontal Extension of Roof Overhang} = \frac{\text{Height of Window (Sill to Overhang)}}{\text{Tangent of Sun's Altitude Angle}}$$

Tangent of the Sun Altitude Angle can be determined by consulting the *ASHRAE Handbook of Fundamentals* or the following factor can be used based on the appropriate latitude:

North Latitude	F Factor*
28°	5.6-11.1
32°	4.0- 6.3
36°	3.0- 4.5
40°	2.5- 3.4
44°	2.0- 2.7
48°	1.7- 2.2
52°	1.5- 1.8
56°	1.3- 1.5

NOTE: *Select a factor according to your latitude. The higher values will provide 100 percent shading at noon on June 21, the lower values until August 1.

The material for this booklet was prepared for NU by Charles Vidich of Charles Vidich Associates, Stafford Springs, Connecticut. Mr. Vidich is also the Principal Planner for the Central Naugatuck Valley Regional Planning Agency in Waterbury, Connecticut.

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